

INNOVATIVE TECHNOLOGIES

Tobacco Bio-oil Kills Agricultural Pests

Cigarette smoking continues to be the leading cause of preventable death and disease in the United States,¹ but tobacco has potentially beneficial uses as well as deadly ones. Gardeners have long known that homemade mixtures of tobacco and water can kill insect pests. But these homemade brews kill desirable insects, too, and could poison animals that ingest them. Now researchers at the University of Western Ontario are finding new ways to turn tobacco into a more selective eco-friendly pest control agent.²

A team led by chemical engineer Cedric Briens heated finely ground tobacco leaves to 500°C in a vacuum, a process called pyrolysis, then collected the condensate. (Since publishing the paper, the team has found they can use the entire plant—leaves and stalks—which makes it easier and cheaper to harvest the tobacco.) The bio-oil was tested against the Colorado potato beetle (*Leptinotarsa decemlineata*), 11 fungi, and 4 bacteria, all of which are agricultural pests.

The bio-oil blocked the growth of the bacteria *Streptomyces scabies* and *Clavibacter michiganensis* and the fungus *Pythium ultimum*. *S. scabies* causes a common potato scab disease that makes potatoes unmarketable, *C. michiganensis* kills young plants and deforms fruits, especially tomatoes, and *P. ultimum* kills seedlings of eggplant, peppers, lettuce, tomatoes, and cucumbers. The bio-oil also killed 100% of Colorado potato beetles, a resistant pest that can destroy potato crops. The other organisms were unaffected.

Nicotine, a key toxin in tobacco, has known insecticidal properties on its own. But even after removing nicotine from the bio-oil, it still potently killed these few pests.² The authors say the

active components probably include a mixture of phenols with known pesticidal properties working synergistically. They analyzed the bio-oil using gas chromatography–mass spectrometry and note that some of the constituents defy detection. It's possible new pesticidal molecules are being formed in the high heat conditions of pyrolysis. "We do know that no single molecule is effective, and we seem to have discovered a natural cocktail," Briens says.

The probable mixture of active chemicals suggests agricultural pests may not readily develop resistance to the bio-oil. Control of the Colorado potato beetle is especially challenging because the beetle is notorious for its ability to adapt rapidly to new pesticides that are applied.³ "Insecticides that work now will be obsolete in a few years, and we'll need new insecticides," Briens says.

The ability of the bio-oil to target certain agricultural pests could be an asset for future commercialization, because it could spare desirable insects such as honeybees. Some pesticide manufacturers are watching the bio-oil work, but they want to know the active molecules before becoming involved. Then the active components of the bio-oil will require toxicity testing to assess their impact on the environment.

Briens' study "is a logical and efficient approach to identify a useful by-product of tobacco plants, creating a value-added pesticidal fraction," says Joel Coats, a professor of entomology and toxicology at Iowa State University in Ames. "The possibility of discovering a novel pesticidal molecule makes the project very worthwhile."

Carol Potera, based in Montana, has written for EHP since 1996. She also writes for *Microbe*, *Genetic Engineering News*, and the *American Journal of Nursing*.

REFERENCES

1. Dube SR, et al. Vital signs: current cigarette smoking among adults aged ≥ 18 years—United States, 2009. *MMWR* 59(35):1135–1140 (2010). Available: <http://tinyurl.com/2v3esrz> [accessed 8 Dec 2010].
2. Booker CJ, et al. Experimental investigations into the insecticidal, fungicidal, and bactericidal properties of pyrolysis bio-oil from tobacco leaves using a fluidized bed pilot plant. *Ind Eng Chem Res* 49(20):10074–10079 (2010). doi:10.1021/e100329z.
3. Insecticide Resistance in Colorado Potato Beetles [website]. Orono, ME:University of Maine Cooperative Extension (updated 19 Feb 2010). Available: <http://tinyurl.com/34mbkd2> [accessed 8 Dec 2010].

The Beat

by Erin E. Dooley

Report Finds Estimates of Gulf Coast Exposure to Carcinogens Off

The Natural Resources Defense Council reports the FDA underestimated seafood consumption by Gulf Coast residents in developing their June 2010 protocol for determining safe seafood levels of

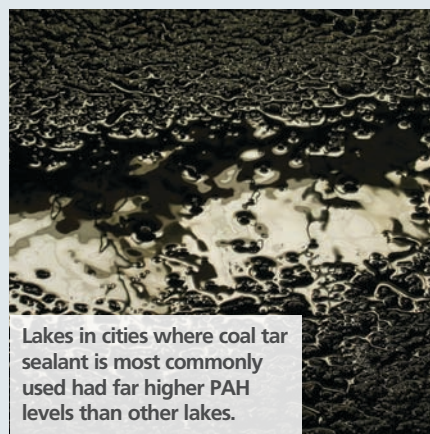


Gulf Coast residents eat an average of two shrimp meals per week, twice the FDA estimate.

toxic PAHs following the BP *Deepwater Horizon* oil spill.¹ The FDA used national consumption data, rather than region-specific information and also did not take into account the dietary patterns of subpopulations including children and the region's large Vietnamese-American population. Gulf Coast shrimp consumption rates were found to range from 3.6 to 12.1 times higher than the FDA estimates.

Federal Bedbug Summit in February

On 1–2 February 2011 the Federal Bed Bug Workgroup will sponsor the second national bedbug summit in Washington, DC.² The meeting will be open to the public and accessible via a webinar. The workgroup will review the current bedbug problem and seeks to identify and prioritize actions to manage and control these increasingly prevalent and resistant pests.



Lakes in cities where coal tar sealant is most commonly used had far higher PAH levels than other lakes.

Coal Tar Sealant a Significant Lake Pollutant

USGS researchers used a chemical mass-balance model to show that coal tar pavement sealants were the chief source of PAHs flowing into 40 U.S. urban lakes.³ Surface water concentrations of PAHs, which are a probable human carcinogen

Left to right: Jiang Hongyan/Shutterstock; Sean McBride/Stockphoto

CHILDREN'S HEALTH

School Siting: EPA Says Location Matters

Fifty-three million U.S. children and 6 million employees spend much of the day in a public or private school.¹ Pollution problems in these settings are so widespread that the Congress mandated in the Energy Independence and Security Act of 2007 that the U.S. Environmental Protection Agency (EPA) develop model guidelines for choosing healthier sites for new schools. On 17 November 2010, the agency released a draft of its new voluntary guidelines.^{1,2}

About 1,900 new schools were built in the 2008–2009 school year, according to the EPA, continuing a relatively similar construction trend since 2002³ and bringing the total number of public and private schools to about 135,000.¹ The number of existing schools in settings that could be harmful to children is unknown, says Peter Grevatt, director of the EPA Office of Children's Health Protection.

The guidelines are designed mainly for use in siting new primary and secondary (K–12) schools, but the principles behind the guidelines could be adapted for many other existing and new settings where children spend long periods. They cover a wide range of topics, including toxicity on the school site and from nearby properties; other health-related issues such as bicycle and pedestrian access to increase student exercise; maximizing community use of the school; and minimizing disruption of relatively undisturbed environments.

Jason Hartke, vice president of national policy for the U.S. Green Building Council, is generally pleased with the congressional mandate and EPA's actions so far. "There is a strong need for EPA guidelines," he says. "This is another really important tool in the toolbox" for creating healthier schools.

Stephen Lester, science director for the Center for Health, Environment & Justice, also is generally supportive: "There's a lot

of good information in these guidelines." But he says they offer too much wiggle room for allowing schools to be built on toxic sites, such as Superfund properties. He'd rather see language that sanctions such decisions only as a very last resort. That's important, he says, because school districts "never have enough money for monitoring and maintenance," even if the original planning, design, and engineering for mitigating toxicity problems were deemed acceptable. He also would prefer a no-exceptions guideline that directs use of the more-protective cleanup standard for residential use for all school sites.⁴

A broader concern is that many school districts may choose to ignore the voluntary guidelines. Interest in environmental health issues "is very spotty," Lester says, especially when so many other issues—including site availability, zoning, and cost—are high priorities. Even in the U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) voluntary certification process for schools,⁵ toxicity issues account for only 10 of the 110 optional points.⁶

The public can comment on the draft guidelines until 18 February 2011. A final version is scheduled for release in late 2011.

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REFERENCES AND NOTES

1. EPA. School Siting Guidelines [website]. Washington, DC:U.S. Environmental Protection Agency. Available: <http://tinyurl.com/2euzcn> [accessed 8 Dec 2010].
2. The EPA can't set mandatory regulations for siting schools, since local jurisdictions typically have that authority, but federal, state, and tribal governments can intercede when possible violations of various laws are involved.
3. Abramson P. School Planning and Management, 15th Annual School Construction Report (Feb 2010). Dayton, OH:Peter Li Education Group. Available: <http://tinyurl.com/23en8cd> [accessed 8 Dec 2010].
4. A residential cleanup standard is more protective than a commercial cleanup standard in part because it assumes children will spend more time on the property.
5. U.S. Green Building Council. LEED 2009 for Schools New Construction and Major Renovations Rating System. Washington, DC:U.S. Green Building Council (updated 2010). Available: <http://tinyurl.com/239wyxk> [accessed 8 Dec 2010].
6. The LEED baseline criteria stipulate that old landfill sites should be completely avoided and that contamination from other former uses should be cleaned up to meet the most stringent appropriate standard. One point is available for siting a school on a remediated brownfield site, which critics such as Lester say should be done only as a last resort. Nine points are available for reducing vehicle use to lessen emissions or increase student exercise via bicycling or walking. Eight points are available for meeting other site criteria addressed by the EPA guidelines, such as utilizing existing roads and utilities, avoiding 100-year floodplains, protecting or restoring habitat, and encouraging joint community use of school facilities.

and are toxic to fish and other aquatic life, have been increasing in recent decades. Being able to determine the source of these PAHs will help in the design better ways to manage them. Some U.S. municipalities have already banned coal tar sealants.

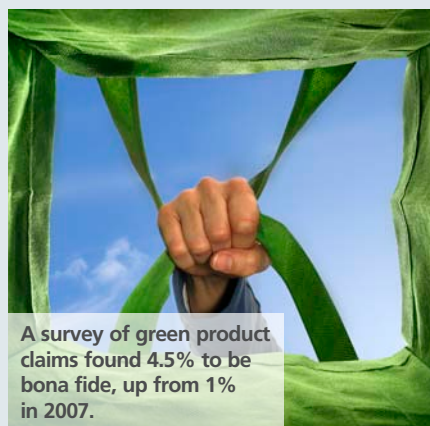
Ford Cottons to Recycling

Ford Motor Company recently announced its 2012 Ford Focus models will use carpet backing and soundproofing materials made from recycled cotton denim.⁴ Cotton production can have a large environmental footprint, and clothing and other textiles represent about 4% of municipal solid waste.⁵ Each car will use an amount of postconsumer cotton equal to the amount in two pair of jeans.⁴

Greenwashing Update

"Greenwashing" is the term for ads and labels that promise more environmental benefit than they deliver.⁶ The third in a series of reports by TerraChoice

Environmental Marketing finds that marketers are getting better at substantiating claims of "greenness" about their products.⁷ The number of self-described green products tallied on shelves increased 73% between 2009 and 2010, with 4.5% of such products making credible claims. In 2007, only 1% of the claims made by surveyed products could be



verified. One area where marketing claims have skyrocketed is in products claiming they have no bisphenol A (up 577% over 2009) or no phthalates (up 2,550% over 2009).

REFERENCES

1. NRDC. Gulf Coast Seafood Consumption Survey. Washington, DC:Natural Resources Defense Council (2010). Available: <http://tinyurl.com/24b3mxx> [accessed 10 Dec 2010].
2. EPA. Second National Bed Bug Summit [website]. Washington, DC:U.S. Environmental Protection Agency (updated 9 Dec 2010). Available: <http://tinyurl.com/23sfmd8> [accessed 10 Dec 2010].
3. Van Metre PC, Mahler BJ. Contribution of PAHs from coal-tar pavement sealcoat and other sources to 40 U.S. lakes. *Sci Total Environ* 409(2):334–344 (2010); doi:10.1016/j.scitotenv.2010.08.014.
4. Ford Motor Company. A perfect fit: recycled clothing finds a new home inside next-generation Ford Focus [press release]. 30 Nov 2010. Dearborn, MI:Ford Motor Company. Available: <http://tinyurl.com/34ffp67> [accessed 10 Dec 2010].
5. Claudio L. Waste couture: environmental impact of the clothing industry. *Environ Health Perspect* 115(9):A449–A454; doi:10.1289/ehp.115-a449.
6. Dahl R. Greenwashing: do you know what you're buying? *Environ Health Perspect* 118(6):A246–A252 (2010); doi:10.1289/ehp.118-a246.
7. TerraChoice Environmental Marketing. The Sins of Greenwashing: Home and Family Edition. London, UK:TerraChoice Environmental Marketing (2010). Available: <http://tinyurl.com/2d89tx8> [accessed 10 Dec 2010].